

Development of the GUI-Based Control Input Editor for MARS

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1. Introduction

Best-Estimate (B-E) Thermal-Hydraulic (T/H) codes such as RELAP5, MARS [1] and RETRAN are widely used to analyze the transient responses of Nuclear Power Plants. However, their input and output features, which normally are in a text format, are outdated. Recently many efforts have been made to replace the old I/O features of the B-E codes with a Graphic User Interface (GUI). Even though these efforts have improved the I/O features compared with the text-based I/O features of the current T/H codes, it is still difficult to convert the control logics in actual plants into the text-based control system input. To help the control system input preparation, Korea Atomic Energy Research Institute (KAERI) has developed the GUI-based control input editor for MARS as a component of Visual System Analyzer (Visa) [2, 3]. The control input editor converts the text-based control system input into logic diagrams, so a user can easily examine the complex control input through the window. Moreover a user can also modify the existing control system input and create a new control system input using this feature.

2. Development of MARS GUI control input editor

The GUI-based control input editor has been developed as a component of ViSA using Delphi program language. This editor consists of three main parts: 1) Control Module List Window which displays the list of control modules in the selected input. Control Module is a complete control system normally used to control some components, i.e., valves, control rods, pump, etc. and consists of many control elements. 2) Block Diagram Window which shows the connections of control elements in block diagram. 3) Details Window which displays the detailed input value of a selected control element. Figure 1 shows the GUI-based control input editor. This figure also illustrates the control block diagram for a selected control module and figure 2 shows the text-based input for the same control module.

2.1. Control module list

Control module represents a complete control system which consists of a series of control elements. It is only used by the hydraulic components such as valve, time dependent junction, etc., and not used as a part of other control system. Therefore control module list window doesn't display the list of all control elements in the input deck but shows the list by a unit of 'control module'. A user can also create the new control module

from the 'Add' menu in this window using right-click button.

2.2. Block Diagram Window

In this window, a user can check the connection of all control elements through the block diagram, and add a new control element, and delete an existing control element in a selected control module. Block diagram shows all the control elements in a selected control module except the independent variables such as a void fraction, pressure, etc. These independent variables are shown in 'Details' window and can be modified by a user. Using this window, a user can easily examine the overall control logics for specific control system.

2.3. Details window

As mentioned in the previous section, Details window shows all input data of a selected control element. In this window, a user can modify the existing value, and add or remove the input components for a selected control element. For example, control variable 129 consists of two input components, cntrlvar 127 and 128, respectively. If a user wants to add an input component for control element 129, it can be simply done by increasing the number of input data from 2 to 3.

3. Conclusion

To support the MARS code users for preparing the control system input, a user-friendly control system input editor for MARS has been developed. Figures 1 and 2 illustrate the effectiveness of the GUI-based control input editor. The useful functions of GUI editor can help a user to prepare complex control input more effectively, such as control logic for real plant, than the control system input of a current T/H code which is still used in a text-based environment.

ACKNOWLEDGEMENTS

This work has been performed as a part of the Nuclear R&D Program supported by the Ministry of Science and Technology (MOST) of the Republic of Korea.

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